DESCRIPTION

SHEET METAL REPAIR SUPPORT DEVICE AND JIG THEREOF

Technical Field

The present invention relates to a sheet metal repair support device and, more specifically, to a device for supporting the sheet metal operation of drawing out a damaged part to the normal position and a jig thereof.

Background Art

As a device for drawing out a damaged part, there is known, for example, a sheet metal working instrument which draws out a damaged part using a panel surface around the damaged part as a fulcrum (see, for example, JP 10-250535 A).

More specifically, the instrument is equipped with a rail extending over the damaged part, a pulling portion (puller) slidably suspended from this rail, a leg portion frame slidable in the longitudinal direction of the rail, leg parts respectively extending toward the panel surface from one end of the leg frame and of the rail, and suction pads provided at the distal ends of the leg parts.

Further, in drawing out the damaged part, the suction pads are first fixed to the panel surface around the damaged part, and then the pulling portion is arranged over the damaged part.

Subsequently, a washer is welded to the damaged part, and the distal end of the pulling portion is connected to this washer. Then, in this state, the pulling portion is operated to draw out the damaged part to the normal position using the panel surface, to which the suction pads are fixed, as a fulcrum.

Incidentally, after careful study, the present inventors have found out various points in need of improvement regarding the sheet metal operation using a sheet metal working instrument of this type.

First, when drawing out the damaged part, a large reaction force is applied to the panel surface through the leg parts. This reaction force is applied perpendicularly to the panel surface. Thus, when the panel surface serving as the place where the leg parts are fixed has a shortage of rigidity, a secondary damage such as distortion is generated in the panel surface due to this reaction force.

Further, in the prior art, in order to avoid such secondary damage, the rigidity of the panel surface, the arrangement of the leg parts, etc. are sufficiently examined before starting the operation of drawing out the damaged part. However, the rigidity of the panel surface, the appropriateness in the arrangement of the leg parts, etc. are not to be easily judged at a glance, and an appropriate arrangement of the leg parts requires great skill and years of experience. Thus, when an unskilled operator performs the operation, there is a fear of causing a secondary damage due

to the reaction force of the leg parts as stated above.

Further, to draw out the damaged part efficiently, it is necessary to draw out the damaged part in a circle from outside the damaged part toward the center of the damaged part. In this regard, in the conventional sheet metal working instrument, in which the moving direction (movable direction) of the pulling portion is restricted to a straight line along the rail, so that it is impossible to realize diverse drawing operations such as one in a circle.

The present invention has been made in view of the background as described above. It is an object of the present invention to provide a sheet metal repair support device capable of suppressing a secondary damage to the panel surface due to the drawing of the damaged part. Further, the present invention aims to provide a sheet metal repair support device having a satisfactory operability and adaptable also to diverse drawing orders.

Disclosure of the Invention

The present invention provides a sheet metal repair support device including a drawing device for drawing out a damaged part, and a plurality of leg parts fixed to a panel surface around the damaged part, the sheet metal repair support device being adopted, when drawing out the damaged part, to draw out the damaged part by using the leg parts fixed to the panel surface as fulcrums,

characterized in that the leg parts are connected to the drawing device at angles providing predetermined inclinations with respect to normal lines extending from the panel surface constituting a fixation place.

In the present invention constructed as described above, the leg parts are connected to the drawing device at angles providing predetermined inclinations with respect to the normal lines extending from the panel surface where the leg parts are fixed, supporting the drawing device over the damaged part. Thus, part of the reaction force in the vertical direction applied to the panel surface when the damaged part is drawn out is transmitted to the panel surface while dispersed in other directions due to the inclined arrangement of the leg parts. Thus, the reaction force in the vertical direction applied to the panel surface is reduced, whereby generation of a secondary damage due to this reaction force is suppressed.

Further, it is desirable for the inclinations of the leg parts be set within a range in which the damaged part to be drawn out and the leg parts make acute angles. When the inclinations are set within this range, the leg parts are arranged so as to be widened out with respect to the drawing device, and the reaction force acting on the leg parts is scattered to the outside of the damaged part. Thus, it is possible to avoid generation of a secondary damage more reliably.

Further, each of the leg parts may be swingably supported with respect to the drawing device. In this construction, in which the leg parts are swingably supported with respect to the drawing device, so that, even if the panel surface, to which the leg parts are fixed, has an undulation, it is possible to arrange the leg parts at angles adapted to the undulation.

Further, each of the leg parts may be provided with a movable portion varying an angle at which the distal end of the leg part is held in contact with the panel surface. In this construction, even if the panel surface, to which the leg parts are fixed, is inclined, the inclination is absorbed by the movable portions provided on the leg parts, so that the relative inclination of the leg parts and the panel surface is corrected. Thus, it is possible to fix the leg parts to the panel surface at proper angles.

Further, it is possible to adopt a construction further including a set of sub frames supported over the damaged part through the leg parts, and a main frame supporting the drawing device so as to allow sliding in a longitudinal direction of the main frame, in which the main frame is connected to the sub frames through a frame bracket slidable with respect to an axial direction of the sub frames.

In this construction, the drawing device is slidable in the axial direction of the main frame, and the main frame is slidable in the axial direction of the sub frames. That is, the drawing device

is movable over the damaged part in plane-matrix directions. Thus, it is possible to draw out the different portions of the damaged part in an appropriate order.

Further, the frame bracket may be equipped with a movable portion rotatable circumferentially around the main frame, and the main frame and the sub frames may be connected to each other through the movable portion.

In this construction, the movable portion rotating around the main frame is incorporated into the frame bracket, and the sub frames and the main frame are connected to each other through the movable portion. Thus, it is possible to appropriately change the relative angle of the main frame and the sub frames by means of this movable portion.

Further, the frame bracket may be constructed such that it detachably holds at least one of the main frame and the sub frames. In this construction, it is possible to perform operation with the sub frames and the main frame separated.

Further, the leg parts may each be equipped with a suction pad for fixation to the panel surface by a suction force, and the sub frames may be formed as hollow components, with a negative pressure generating the suction force of the suction pad being supplied to the suction pad through the hollow sub frames. In this construction, in which the negative pressure is supplied to the suction pad through the sub frames, it is possible to simplify the routing structure

for negative pressure pipes, etc.

Further, in the present invention, in addition to the above-described sheet metal repair support device, the following jig also helps to support sheet metal repair.

That is, the present invention provides a jig for a sheet metal repair support device including a drawing device for drawing out a damaged part, and a plurality of leg parts fixed to a panel surface around the damaged part, the sheet metal repair support device being adopted, when drawing out the damaged part, to draw out the damaged part by using the leg parts fixed to the panel surface as fulcrums, characterized in that the jig is equipped with a base plate portion fixed to a periphery of the damaged part, and a fixation plate forming in a vicinity of the leg parts of the sheet metal repair support device a fixation plate serving as the panel surface constituting a proper fixation place using the base plate portion as a fulcrum.

Further, an angle adjusting mechanism for adjusting a support angle of the fixation plate with respect to the base plate portion may be provided between the base plate portion and the fixation plate.

Further, at least one of the base plate portion and the fixation plate may be provided with a slide mechanism supporting the fixation plate slidably with respect to the base plate portion.

As described above, in accordance with the present invention, it is possible to provide a sheet metal repair support device capable

of suppressing a secondary damage of the panel surface due to the drawing out of a damaged part. Further, it is possible to provide a sheet metal repair support device having a satisfactory operability and adaptable to diverse drawing orders.

Brief Description of the Drawings

Fig. 1 is a diagram schematically showing the construction of a sheet metal repair support device according to an embodiment of the present invention.

Fig. 2 is a plan view of the sheet metal repair support device according to the embodiment.

Fig. 3 is a side view of the sheet metal repair support device according to the embodiment.

Fig. 4 is a front view of the sheet metal repair support device according to the embodiment.

Fig. 5 is a diagram schematically showing the construction of a drawing device according to the embodiment.

Fig. 6 is a diagram showing how operation is performed by using the sheet metal repair support device according to the embodiment.

Fig. 7 is a diagram showing how the sheet metal repair support device according to the embodiment is installed on a vehicle by using a jig.

Fig. 8 is a front view of the jig according to the embodiment.

Fig. 9 is a side view of the jig according to the embodiment.

Best Mode for carrying out the Invention

In the following, a preferred embodiment of the present invention will be described with reference to the drawings.

A sheet metal repair support device 1 according to this embodiment is equipped with a main frame 10 extending over a damaged part D, sub frames 20 connected to the main frame 10, a plurality of leg parts 70 fixed to a panel surface P around the damaged part and supporting the main frame 10 and the sub frames 20 over the damaged part by using the panel surface P as a fulcrum, and a drawing device 40 used to draw out the damaged part.

The main frame 10 is composed of two steel pipes arranged in parallel. The parallelism of the steel pipes is maintained by a set of brackets.

One bracket 50 (the left-hand side bracket in Fig. 1) retains one end of the main frame 10. Further, the bracket 50 is provided with a rotation mechanism which rotatably connects the sub frame 20 (20a) described later with respect to the main frame 10 by using the main frame 10 as a rotation axis.

The other bracket 60 (the right-hand side bracket in Fig. 1) connects the sub frame 20 (20b) to the main frame 10 and is equipped with a slide mechanism slidably supporting the steel pipes constituting the main frame 10 in the axial direction. Further, it is equipped with an attachment/detachment mechanism detachably

retaining the main frame 10 with respect to the sub frame 20b.

In this way, of one set of brackets, one bracket 50 is fixed to one end of the main frame 10, and the other bracket 60 is provided so as to be longitudinally slidable using the main frame 10 as an axis. Thus, by moving the other bracket 60 toward or away from one bracket 50, the distance between the sub frames 20a, 20b is changed, so that the distance between the leg parts 70 can also be changed.

In the following, one bracket 50 will be referred to as "the stationary bracket 50". The other bracket 60 will be referred to as "the slide bracket 60".

The sub frames 20 are formed by a pair of hollow steel pipes connected to the main frame 10 through the intermediation of the stationary bracket 50 or the slide bracket 60.

In the following, based on the details on the brackets 50, 60, the way the sub frames 20a, 20b and the main frame 10 are connected will be described.

Fig. 2 shows in detail how the sub frame 20a and the main frame 10 are connected on the stationary bracket 50 side.

As stated above, the stationary bracket 50 is provided with a rotation mechanism rotatably supporting the sub frame 20a using the main frame 10 as an axis. This rotation mechanism is incorporated into the stationary bracket 50.

The stationary bracket 50 is equipped with a main block 51 fixed to one end of the main frame 10, a rotation shaft 52 extending

from the main block 51, and an auxiliary block 53 retaining the sub frame 20a so as to allow it to slide in a direction perpendicular to the main frame 10. Further, a bearing is formed in the auxiliary block 53, and the rotation shaft 52 is incorporated into the bearing of the auxiliary block 53.

That is, the auxiliary block 53 is rotatable relative to the rotation shaft 52 extending from the main block 51, and the sub frame 20a is rotatable relative to the main frame 10 by being connected to the main frame 10 through the intermediation of the auxiliary block 53. Further, in this embodiment, the above mechanism forms the movable portion of the frame bracket of the present invention.

Subsequently, the way the sub frame 20b and the main frame 10 are connected on the slide bracket 60 side will be described with reference to Figs. 2 and 3.

As stated above, the slide bracket 60 is equipped with an attachment/detachment mechanism connecting the main frame 10 detachably to the sub frame 20b. This attachment/detachment mechanism is formed by various components incorporated into the slide bracket 60.

The slide bracket 60 is equipped with a main block 61 slidable in the axial direction of the main frame 10 and retaining the sub frame 20 in a direction perpendicular to the main frame 10, and a fastening member 62 collectively fastening the main block 61 and the main frame 10 (steel pipes).

By releasing the fastening member 62, the main frame 10 can be easily detached from the main block 61. Further, when the fastening member 62 is released, the main frame 10 can rotate away from the damaged part, using the stationary bracket 50 as a fulcrum as shown in Fig. 4. When the fastening member 62 is closed, and the main frame 10 is connected to the main block 61, it is possible to maintain the main frame 10 and the sub frames 20 in the state in which they are connected together.

Subsequently, the leg parts 70 will be described.

As shown in Fig. 3, the leg parts 70 have at the lower ends thereof suction pads 72 through the intermediation of universal joints 71 (movable portions), and are fixed to the panel P constituting the place of fixation by the suction force of the suction pads 72.

Further, connected to each suction pad 72 is a negative pressure hose 73 for supplying negative pressure (see Fig. 1). In this embodiment, in routing the negative pressure hoses 73, the negative pressure hoses 73 are connected to the suction pads 72 through the sub frames 20.

Further, the leg parts 70 are connected to the sub frames 20 through the intermediation of leg part brackets 80. Each leg part bracket 80 is equipped with a bracket main body 81 slidable in the axial direction of the sub frame 20 and rotatable in the circumferential direction of the sub frame 20 using it as an axis, an angle setting lock mechanism 82 for fixing the bracket main body

81 to the sub frame 20 at an appropriate position and angle, and a height setting lock mechanism 83 for fixing the position of the leg part 30 with respect to the bracket main body 81 at an appropriate position (height).

By operating the lock mechanisms 82, 83, positioning is effected on the leg parts 70 with respect to the sub frames 20, whereby the support angles and heights of the leg parts 70 with respect to the sub frames 20 and the distance (span) between the leg parts 70 are determined. In this embodiment, there are provided two leg parts for each sub frame 20, i.e., four leg parts 70 in total for the entire sheet metal repair support device 1.

Subsequently, a drawing device 40 will be described.

As shown in Figs. 1 and 5, the drawing device 40 is equipped with a main body portion 41 supported so as to be slidable in the axial direction of the main frame 10, a draw-out rod 42 extending through the main body portion 41, a ratchet lever 43 which draws out the draw-out rod 42 to the exterior of the main body portion 41 through a gear 42a formed on the side surface of the draw-out rod 42, an electrodeposition portion 44 mounted to the distal end of the draw-out rod 42, and an operating handle 45 for imparting twist to the draw-out rod 42.

The drawing device is operated as follows. First, the electrodeposition portion 44 is fixed to a damaged part D. Then, the ratchet lever 43 is repeatedly operated to move the draw-out

rod 42 away from the damaged part D. At this time, the electrodeposition portion 44 is fixed to the damaged part D, so that the damaged part D is drawn out to the main body 41 side together with the electrodeposition portion 44. When the drawing-out of the damage part D is completed, the operating handle 45 provided on the draw-out rod 42 is twisted, whereby twist is imparted to the electrodeposition portion 44, and the electrodeposition portion 44 is detached from the damaged part D. By thus repeatedly operating the ratchet lever 43, the damaged part D is gradually drawn out toward the normal position. The draw-out rod 42 is graduated, and, owing to this graduation, it is possible to grasp the amount by which the draw-out rod 42 is drawn out.

Subsequently, the method of using the above-described sheet metal repair support device 1 will be described with reference to the operation of drawing out a damaged part formed on a panel surface of a vehicle.

First, prior to the installation of the sheet metal repair support device 1, the configuration of the damaged part is grasped. Then, the sub frame 20b is caused to slide in the axial direction of the main frame 10 through the intermediation of the slide bracket 60, and the leg parts 70 are caused to slide relative to the sub frames 20, adapting the distance (span) between the leg parts 70 and their positions to the configuration of the damaged part. This operation corresponds to the operation of enlarging the distance

between the leg parts 70 with respect to the damaged part, and is not such a sophisticated operation as would require, for example, correct computation of the exact positions of the leg parts 70.

Further, in this embodiment, after adjusting the distance between the sub frames 20a, 20b, a jig X as shown in Fig. 1 is fitted into the end portion of each of the sub frames 20a, 20b in order to maintain this distance, and in this state, the present device 1 is fixed to the damaged part. That is, the movement of the sub frames 20a, 20b is regulated by the jig X, making it possible to fix the present device 1 to the damaged part.

As shown in Fig. 1, each jig X is equipped with a main body portion X2 whose total length can be adjusted by an adjusting portion X1, and engagement portions X3 provided on the both ends of the main body portion X2, which can be engaged with the end portions of the sub frames 20a, 20b; when using the jig, each of the engagement portions X3 is engaged with the end portion of the corresponding sub frame 20, and the total length is adjusted by the adjusting portion X1, whereby an external force (tension) is imparted to the sub frame 20, restraining undesired movement of the sub frame 20.

Subsequently, the leg part brackets 80 are operated to impart inclination to the support angles of the leg parts 70. More specifically, as shown in Figs. 1 and 4, the leg parts 70 are fixed to the panel surface at angles providing predetermined inclinations with respect to normal lines L extending from the panel surface

to which the leg parts 70 are fixed.

While the inclination angles of the leg parts 70 can be set arbitrarily, inclination is preferably imparted to the leg parts 70 within a range in which the angles θ made by the damaged part to be drawn out and the leg parts 70 are acute angles, and more preferably, within the range of 60 to 80 degrees.

To be more specific about the angles θ made by the above-mentioned damaged part and the leg parts 70, the angles θ correspond to the angles made by the leg parts 70 and the straight lines connecting the proximal points of the normal lines extending from the panel surface toward the leg part brackets 80 and the positions where the leg parts 70 supported by the leg part brackets 80 are fixed.

Subsequently, the fastening member 62 provided on the slide bracket 60 is released, and the main frame 10 is opened in a direction opposite to the damaged part, using the stationary bracket 50 as a fulcrum. Then, in this state, operations, such as masking and the marking of draw-out points, are effected on the damaged part.

Then, the main frame 10 is connected to the sub frame 20b again through the intermediation of the fastening member 62. Next, the drawing device 40 is operated to lower the draw-out rod 42, and the electrodeposition portion 44 provided at the distal end of the draw-out rod is welded to the damaged part. Then, the ratchet lever 43 provided on the drawing device 40 is operated to draw up the

damaged part to a desired position (see Fig. 6).

In this way, in the sheet panel repair support device 1 according to this embodiment, the leg parts 70 are fixed so as to provide predetermined inclinations with respect to the normal lines L extending from the panel surface, and in this state, the operation of drawing out the damaged part is conducted.

Thus, the reaction force in the direction perpendicular to the panel surface acting on the leg parts 70 when drawing out the damaged part is diffused to the outside of the damaged part, whereby a secondary damage of the panel surface due to the operation of drawing out the damaged part is avoided.

In this embodiment, the leg parts 70 are fixed to the panel surface by utilizing the suction force of the suction pads 72. Thus, the dispersed reaction force (e.g., the reaction force horizontal to the panel surface) is absorbed by deformation of the suction pads. That is, by adopting the suction pads 72, it is possible to further reduce the reaction force acting on the panel surface.

Further, the inclinations, i.e. the support angles, of the leg parts 70, can be easily changed whenever necessary by operating the leg part brackets 80 provided on the sub frames 20.

Further, in the sheet metal repair support device 1 according to this embodiment, it is possible to separate the sub frame 20b and the main frame 10 at the slide bracket 60, so that, as stated above, even after the installation of the sheet metal repair support

device 1, it is possible to perform operation over the damaged part.

Further, in this embodiment, by sliding the main frame 10 relative to the sub frames 20, and by sliding the drawing device 40 relative to the main frame 10, it is possible to move the drawing device 40 in plane-matrix directions of the damaged part (the X-direction and the Y-direction in Fig. 2). Thus, it is possible to perform the drawing-out operation in diverse drawing orders, for example, in a drawing order in which the damaged part is drawn out successively in a circle from the outer periphery toward the center of the damaged part.

Next, a jig used in sheet metal repair by means of the sheet metal repair support device 1 will be described.

While in the above example the leg parts 70 are directly fixed to the panel surface P, by using the jig described below, it is possible to install the sheet metal repair support device 1 in a stable manner over the damaged part in a condition in which the fixing positions for the leg parts 70 cannot be secured in the vicinity of the damaged part.

In the following, the jig for the sheet metal repair support device 1 of the present invention will be described with reference to the drawings.

Fig. 1 shows a jig 100 forming fixation places for the leg parts 70 on a side surface of a tire T by utilizing the tire T of the vehicle.

As shown in Fig. 1, the jig 100 is equipped with a semi-circular acrylic resin plate 101 whose radius is substantially equal to the radius of curvature of the tire T, and L-shaped stays 102 (base plate portions) provided in the peripheral edge of the acrylic resin plate 101; when using the jig, the stays 102 are engaged with the tread surface of the tire T to secure a fixation surface (fixation plate) formed by the acrylic resin plate 101 on the side surface of the tire T.

Then, by fixing the leg parts 70 to the side surface of the tire T, it is possible to fix the sheet metal repair support device 1 in a stable manner over the damaged part even in a position where the panel area is small, for example, in a position in the vicinity of the tire house.

Further, Figs. 7 through 9 show a jig 110 which secures fixation places for the leg parts 70 by utilizing the hood of a vehicle.

For example, as shown in Fig. 7, the jig 110 is equipped with a base plate portion 111 to be fixed to the portion of a hood B around the damaged part, and a fixation plate 112 forming, by using the base plate portion 111 as a fulcrum, a fixation surface serving as a panel surface constituting the proper fixation place in the vicinity of the leg parts 70 of the sheet metal repair support device 1.

Further, as shown in Fig. 7, in using the jig, the jig 110 is fixed to the hood B of the vehicle, and the leg parts 70 of the

sheet metal repair support device 1 are fixed to the fixation plate 112. That is, by using the jig 110, even in a condition in which the fixation surface for the leg parts 70 cannot be secured on the panel surface P in the vicinity of the damaged part, it is possible to secure the fixation surface for the leg parts 70 in the vicinity of the leg parts 70 by utilizing another panel surface (e.g., the hood).

In the following, its construction will be described in detail.

As shown in Fig. 8, the base plate portion 111 consists of a flat plate having on the back side a plurality of suction pads 113, whereas the fixation plate 112 is fixed to the end portion of the base plate portion 111 through the intermediation of hinges 114. Further, as shown in Fig. 9, between the base plate portion 111 and the fixation plate 112, there is provided an angle adjusting mechanism. This angle adjusting mechanism is equipped with a stay 111a provided on the surface of the base plate portion 111, a stay 112a extending from the fixation plate 112, and a lock lever 115 securing the stays 111a, 112a at fixed positions.

When operating the jig, the fixation plate 112 is adjusted to a desired angle with respect to the base plate portion 111, and then the lock lever 115 is operated to collectively fasten the stays 111a, 112a. Thus, the support angle of the fixation plate 112 with respect to the base plate portion 111 is maintained at an appropriate angle.

Further, the suction pads 113 are provided so as to be slidable with respect to the base plate portion 111, and position adjustment of the base plate portion 111 and the fixation plate 112 is possible even after the fixation of the suction pads 113.

The construction of the sheet metal repair support device 1 and the construction of the jig described above, are only presented as a preferred example; regarding their details, they allow modifications as appropriate according to various specifications.

For example, while in the sheet metal repair support device 1 described above the leg parts 70 are swingably connected to the sub frames 20 through the intermediation of the leg part brackets 80, it is also possible to impart inclination to the leg parts 70 by fixing the leg parts 70 to the sub frames 20 and changing the angle of the sub frames 20 with respect to the main frame 10 when installing the sheet metal repair support device 1.

Further, the sub frames 20, the main frame 10, etc. are not always indispensable; for example, a construction may also be adopted in which the leg parts 70 are directly connected to the drawing device 40.

Further, while in the above example the inclination setting for the leg parts 70 is effected by imparting inclination to the leg parts within a range in which the angles θ made by the damaged part and the leg parts 70 are acute angles (angles smaller than a right angle), it is not absolutely necessary to do so; to disperse

the reaction force acting on the panel surface, the angles θ made by the damaged part and the leg parts 70 may also be obtuse angles exclusive of 90 degrees.

In the case in which the setting is made in acute angles, the leg parts 70 are widened out, so that, for example, in a configuration with a swollen central portion as in the case of a vehicle door panel, it is possible to diffuse the reaction force efficiently to the outside of the damaged part.